Work Order ID 67118

Wednesday, March 09, 2011 7:29:22 AM

Item ID: D412-664-203TRN **Accept** **Setup Start**

Revision ID: **Stop**

Item Name: Crosstube Turning Detail

Start Date: 3/9/2011 **Start Qty:** 1.00 **Cust Item ID:**

Required Date: 3/23/2011 **Req'd Qty:** 1.00 **Customer:**

Reference:

Approvals: **Process Plan:** CL **Date:** 11/03/09 **Tooling:** _____ **Date:** _____ **Run Start**

QC: _____ **Date:** _____ **SPC (Y/N):** _____ **Date:** _____ **Stop**

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
Draw Nbr	**Revision Nbr**								
D412-664-243	Rev E								
100	MORI SEIKI CNC LATHE LARGE	0.00				1			
Mori Seiki	**Memo**	0.00							
Mori Seiki CNC Lathe Large	1-Fill tube with sand & install plugs DT8534 on both ends as per Folio FA166 2-Turn first side as per Folio FA166 3- File transition lines smooth.								
110	QC1- Inspect dimensions to dimension sheet	0.00				1			
QC	**Memo**	0.00							
Quality Control									
120	MORI SEIKI CNC LATHE LARGE	0.00				1			
Mori Seiki	**Memo**	0.00							
Mori Seiki CNC Lathe Large	1-Turn second side as per Folio FA166 2- File transition lines smooth. 3- Remove sand and plugs 4-Scribe part # and batch # using vibrating stilus								

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: D412-664-203TRN **PAR #:** _____ **Fault Category:** Machining **NCR:** (Yes) No **DQA:** _____ **Date:** 11.03.16

Resolution: Accepted **Disposition:** Use as is **QA: N/C Closed:** _____ **Date:** 11/03/17

NCR: 67118		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			
11.9	100	3.308" DIMENSION UNDER TOLERANCE BY .004" SO ACTUAL SIZE 3.304" HAD TO BRING IT DOWN TO THIS SIZE TO REMOVE VIBRATION THAT OCCURED DURING FINISH PASS. RC PROCESS.	11.03.10 QS1042	Acceptable. REF ATTACHED SR	11.9	11/3/11	11.03.10 QS1042	11/03/15

NOTE: Date & initial all entries

Work Order ID 67118

Wednesday, March 09, 2011 7:29:23 AM

Item ID: D412-664-203TRN **Accept** **Setup Start**

Revision ID: **Stop**

Item Name: Crosstube Turning Detail

Start Date: 3/9/2011 **Start Qty:** 1.00 **Cust Item ID:**

Required Date: 3/23/2011 **Req'd Qty:** 1.00 **Customer:**

Reference:

Run Start

Approvals: **Process Plan:** _____ **Date:** _____ **Tooling:** _____ **Date:** _____

Stop

QC: _____ **Date:** _____ **SPC (Y/N):** _____ **Date:** _____

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
130	QC1- Inspect dimensions to dimension sheet	0.00				1			
QC	**Memo**	0.00							
Quality Control									
140	QC8- Inspect parts - second check	0.00				1			
QC	**Memo**	0.00							
Quality Control									
150	Crosstubes Chemical Conversion	0.00				0			
HandFXtube	**Memo**	0.00							
Hand Finishing Crosstubes									

11.3.10

11/3/11

SAO 11-03-11

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

NOTE: Date & initial all entries

Work Order ID 67118

Wednesday, March 09, 2011 7:29:23 AM

Item ID: D412-664-203TRN
Revision ID:
Item Name: Crosstube Turning Detail
Start Date: 3/9/2011 **Start Qty:** 1.00
Required Date: 3/23/2011 **Req'd Qty:** 1.00
Reference:

Accept **Setup Start** **Stop**

Cust Item ID:
Customer:

Run Start **Stop**

Approvals: **Process Plan:** _____ **Date:** _____ **Tooling:** _____ **Date:** _____
QC: _____ **Date:** _____ **SPC (Y/N):** _____ **Date:** _____

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
160	QC3- Inspect Part Finish	0.00	DP			11-3-14			
QC	**Memo**	0.00							
Quality Control									
170		0.00							
Packaging	Packaging		DP			11-3-14			(1)
Packaging	**Memo** Identify and stock in kanban rack Location: 4/6	0.00							
180	QC21- Final Inspection - Work Order Release	0.00					11/3/15		
QC	**Memo**	0.00							
Quality Control									

M 11-03-14 (1)

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

NOTE: Date & initial all entries

Picklist Print

Wednesday, March 09, 2011 7:29:19 AM

Work Order ID: 67118

Parent Item: D412-664-203TRN

Parent Item Name: Crosstube Turning Detail

Start Date: 3/9/2011 **Required Date:** 3/23/2011

Start Qty: 1.00 **Required Qty:** 1.00

Comments: IPP Rev:A 08-03-06 new issue DD verified by:eec
IPP Rev B 08.04.02 Removed polish EC verified by: DD

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6009-129 Crosstube Material		Manufactured	No			120	Each	8.0000	1	1			

11-3-10

Location	Loc Qty	Loc Code
LG	8	
38342	2	
53594	6	

Dart Aerospace Ltd

W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

NOTE: Date & initial all entries

DART AEROSPACE LTD	Work Order:	67118
Description: Crosstube Assembly (412 High Aft)	Part Number:	D412-664-243
Inspection Dwg: D412-664-243 **Rev:** E		Page 1 of 1

FIRST ARTICLE INSPECTION CHECKLIST

[X] First Article [] Prototype

	Inspection Sheet Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.684	+0.005/-0.000	2.688	✓		RQ.02	
	2.748	+0.005/-0.000	2.753	✓			
	2.884	+0.005/-0.000	2.889	✓			
	3.019	+0.005/-0.000	3.024	✓			
	3.163	+0.005/-0.000	3.168	✓			
	3.308	+0.005/-0.000	3.304	✓			
	3.429	+0.005/-0.000	3.432	✓			
	2.990	+0.005/-0.000	2.994	✓			
	2.618	+0.005/-0.000	2.623	✓			
	0.200	+/-0.010	.205	✓			
	R0.063	+/-0.010	R.063	✓			
	R0.500	+/-0.010	R.500	✓			
	4.971	+/-0.030	4.960	✓			
SIDE B	2.684	+0.005/-0.000	2.688	✓		RQ.02	
	2.748	+0.005/-0.000	2.743	✓			
	2.884	+0.005/-0.000	2.889	✓			
	3.019	+0.005/-0.000	3.024	✓			
	3.163	+0.005/-0.000	3.167	✓			
	3.308	+0.005/-0.000	3.312	✓			
	3.429	+0.005/-0.000	3.430	✓			
	2.990	+0.005/-0.000	2.993	✓			
	2.618	+0.005/-0.000	2.622	✓			
	0.200	+/-0.010	.200	✓			
	R0.063	+/-0.010	R.063	✓			
	R0.500	+/-0.010	R.500	✓			
	4.971	+/-0.030	4.960	✓			
	124.100	+/-0.020	124.115	✓		RQ.14	

Measured by:		Audited by:		Prototype Approval:	N/A
Date:	11-3-10	Date:	11/3/11	Date:	N/A

Rev	Date	Change	Revised by	Approved
A	04.06.16	New Issue (P/O D412-664-203)	KJ/JLM	
B	06.03.09	Dwg Rev updated	KJ/JLM	
C	07.05.08	Tolerance updated for dimension 4.971	KJ/JLM	
D	10.02.02	Dimension 124.100 was 124.09	KJ	

Item	Qty -243	Part Number	Description
1	X	D412-664-243	CROSSTUBE ASSEMBLY (412 HIGH AFT)
2	1	D6009-129	CROSSTUBE
3	2	D3595-063-570	RUBBER CUSHION
4	1	D2896-1	SUPPORT
5	2	D3189-1	CHAFING SHIELD
6	2	D2856-600-1009	ABRASION STRIP
7	4	MS21920-28	CLAMP
8	2	MS21920-30	CLAMP (OR MS21920-32)
9	A/R	MAGNOBOND 6398	ROCKWELL SPECIFICATION RBO-120-023 ADHESIVE (TEXTRON/BELL SPEC. 299-947-100, TYPE II, CLASS 2 ADHESIVE)

CL 11/03/09
W10:67118

RELEASED
2009 -10- 29

GENERAL NOTES:

1) MATERIAL: MANUFACTURED FROM D6009-129
 FINISHED LENGTH = 124.100±0.020 (BEFORE BENDING/TRIMMING)
2) FINISH: CHEMICAL CONVERSION COAT PER DART QSI 005 4.1
 PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
 PAINT OUTSIDE PER DART QSI 005 4.2
3) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED.
4) UNITS: INCHES UNLESS OTHERWISE NOTED.
5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
6) IDENTIFICATION: SCRIBE DART PART NUMBER "D412-664-243" AND BATCH NUMBER ON INSIDE OF CUFF USING VIBRATING STYLUS.
7) WEIGHT: 47.0 lbs (PER IIN-D212-664)
8) PART IS SYMMETRIC ABOUT CENTERLINE.
9) RUN CUTTER OFF PART. BLEND OUT EDGE LONGITUDINALY, TRANSITION SHOULD BE SMOOTH.
10) BEND PROGRESSIVELY WITH A MINIMUM OF 8 PASSES. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D.
11) LIQUID PENETRANT INSPECT OUTSIDE SURFACE OF CROSSTUBE PER QSI 038.
12) INSTALL D2896-1 SUPPORT USING 0.03" TO 0.06" THICK LAYER OF MAGNOBOND 6398 TO THE SURFACE OF D2896-1 THAT WILL BE IN CONTACT WITH THE CROSSTUBE PER QSI 015. LET CURE FOR 12 HOURS AFTER INSTALLATION AND PRIOR TO PACKAGING.
13) INSTALL MS21920-30 CLAMPS (OR -32) WITH D3595-063-570 RUBBER CUSHIONS TO SECURE THE D2896-1 SUPPORT ON TOP SIDE OF THE CROSSTUBE. ENSURE CLAMPS ARE OPPOSITE OF CROSSTUBE SUPPORT.
14) INSTALL D2856-600-1009 ABRASION STRIPS WITH A 0.13 REF GAP ON BOTTOM SIDE OF CROSSTUBE PER QSI 035.
15) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE.
16) TORQUE CLAMPS 80 TO 100 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING.

REV.	DESCRIPTION	BY	DATE
E	REFORMAT/REVISE GENERAL NOTES; REORGANIZED VIEWS AND REFORMATTED DRAWING TO CURRENT STANDARDS; RELOCATED FLAG #6 PER PAR 08-046 (ZN A6-3); ADD TOLERANCE (ZN B6-3, C4-3, C8-3 & C5-3); MOVED TURNING DETAIL & UPDATED TOLERANCE TO SHEET 4.	RF	09.09.30
D	REMOVE D2732-058, CHANGE TO D3595-063-570	PH	07.03.09
C	REMOVE D2856-600-1087, ADD D2732-058 & MAGNOBOND 6398, MS21920-32 WAS MS21920-30	MB	06.10.27
B	ADD HOLES FOR COMPATABILITY WITH BHT/AA SKIDTUBES	PH	05.02.04
A	NEW ISSUE	PH	01.10.17

DESIGN	PH	**DART AEROSPACE LTD** HAWKESBURY, ONTARIO, CANADA	
DRAWN	RF		
CHECKED		DRAWING NO.	REV. E
MFG. APPR.		D412-664-243	SHEET 1 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE ASSEMBLY (412 HI AFT)	NTS
DATE	09.09.30	COPYRIGHT © 2001 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	

Dart Aerospace Ltd

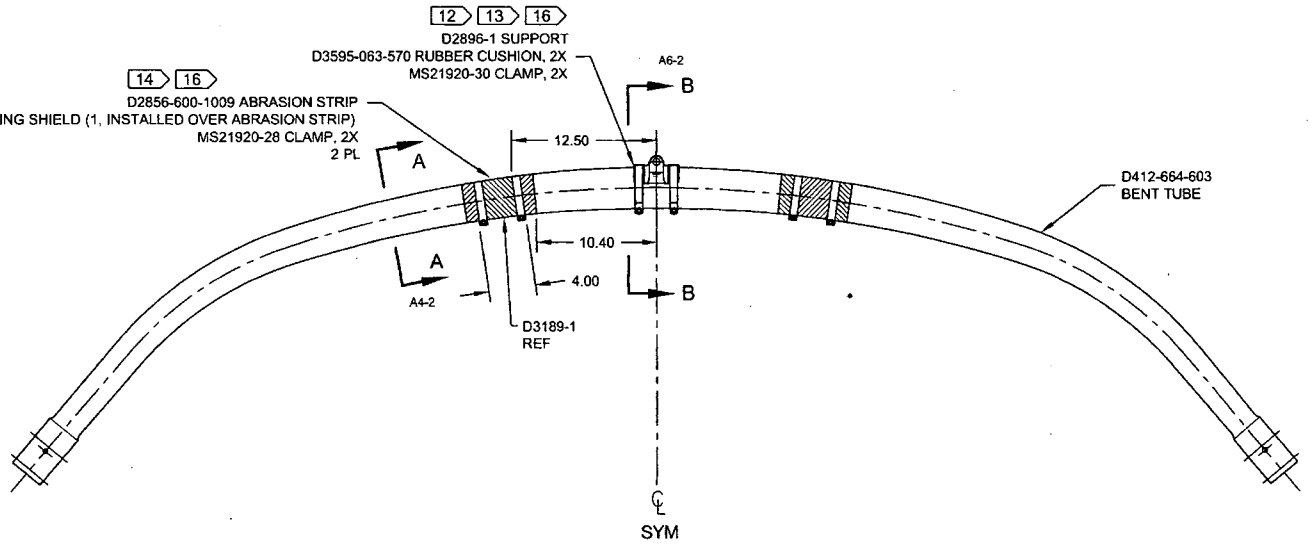
W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

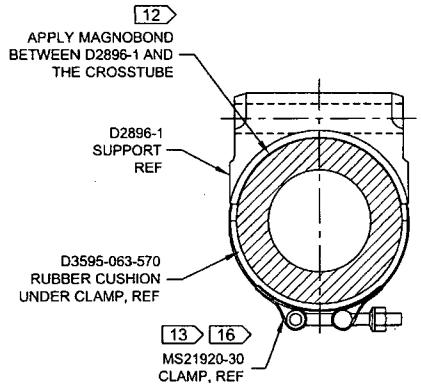
NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

NOTE: Date & initial all entries

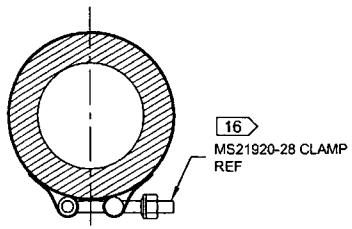


D212-664-243
ASSEMBLY DETAIL E

W10:67118



SECTION B-B D4-2
SCALE 4X



SECTION A-A C6-2
SCALE 4X

RELEASED
2009 -10- 29

DESIGN	AH	DART AEROSPACE LTD	
DRAWN	RF	HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. E
MFG. APPR.		D412-664-243	SHEET 2 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE ASSEMBLY (412 HI AFT)	NTS
DATE	09.09.30		

COPYRIGHT © 2001 BY DART AEROSPACE LTD
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.

Dart Aerospace Ltd

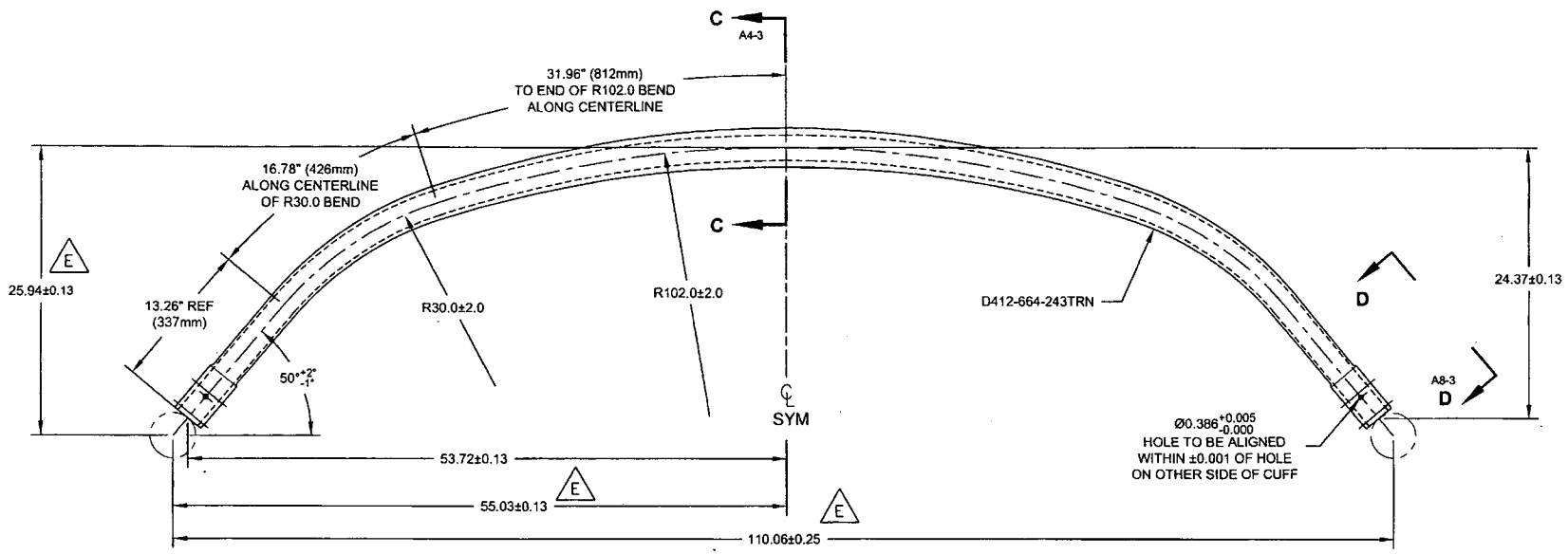
W/O:		WORK ORDER CHANGES					
DATE	**STEP**	**PROCEDURE CHANGE**	**By**	**Date**	**Qty**	**Approval** Chief Eng / Prod Mgr	**Approval** QC Inspector

Part No: _____ **PAR #:** _____ **Fault Category:** _____ **NCR:** Yes No **DQA:** _____ **Date:** _____

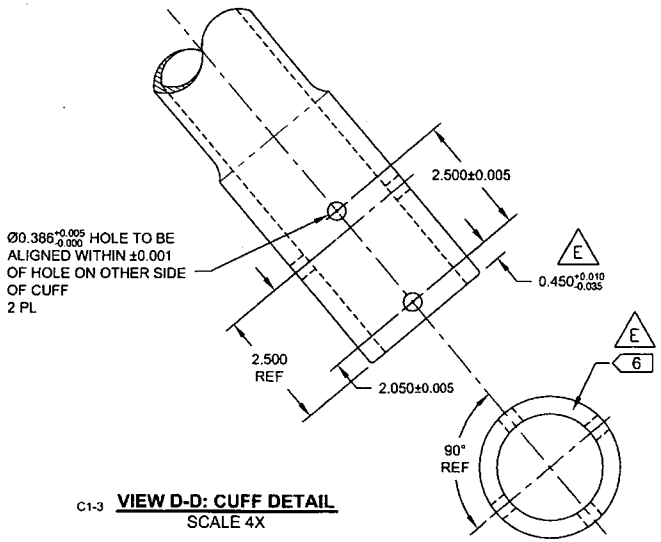
Resolution: _____ **Disposition:** _____ **QA: N/C Closed:** _____ **Date:** _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	**STEP**	**Description of NC** Section A	**Corrective Action** Section B			**Verification** Section C	**Approval** Chief Eng	**Approval** QC Inspector
			Initial Chief Eng	**Action Description** Chief Eng	**Sign & Date**			

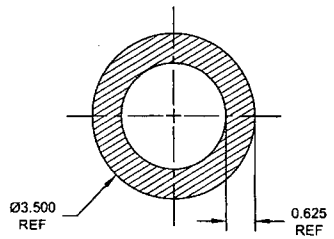
NOTE: Date & initial all entries



D412-664-603 10
BENDING AND DRILLING DETAIL E



C1-3 **VIEW D-D: CUFF DETAIL**
SCALE 4X



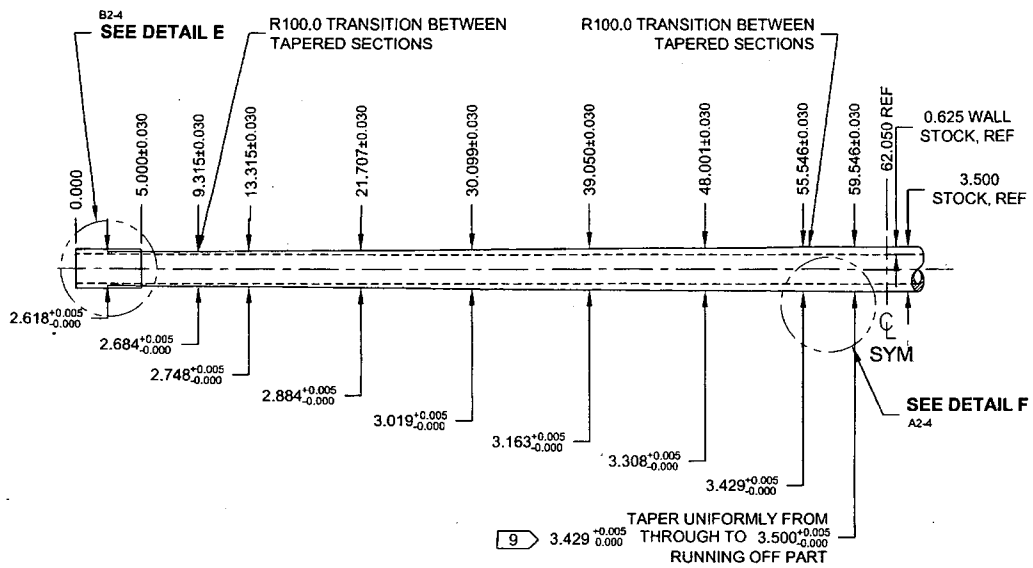
SECTION C-C D5-3
SCALE 4X

W10.67118

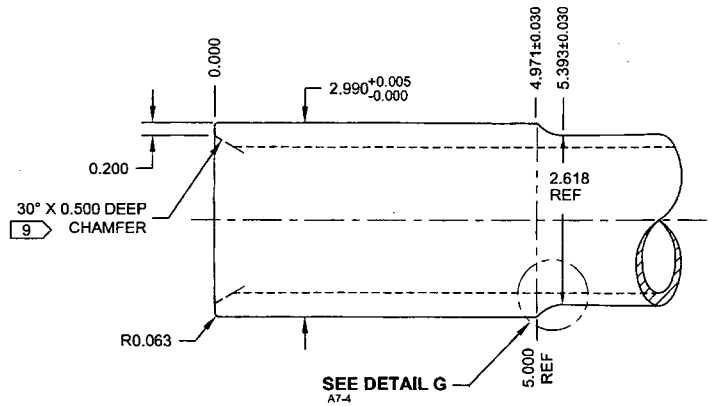
RELEASED
2009 -10- 29
MP

DESIGN	AH	**DART AEROSPACE LTD**	
DRAWN	RF	HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. E
MFG. APPR.		D412-664-243	SHEET 3 OF 4
APPROVED	MP	TITLE	SCALE
DE APPR.		CROSSTUBE ASSEMBLY (412 HI AFT)	NTS
DATE	09.09.30		

COPYRIGHT © 2001 BY DART AEROSPACE LTD
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.

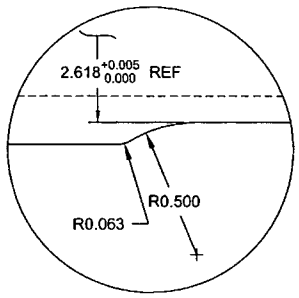


124.100

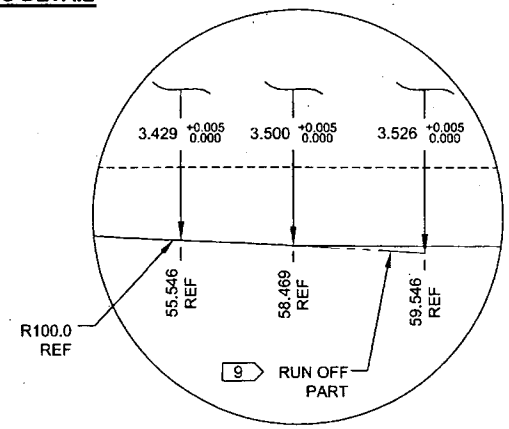


DETAIL E:
CROSSTUBE CUFF D8-4
SCALE 5X

D412-664-243TRN
TURNING DETAIL (E)



DETAIL G:
CUFF TRANSITION C2-4
SCALE 10X



DETAIL F:
TAPER RUN-OFF C4-4
NOT TO SCALE

W/O: 67118

RELEASED
2009 -10- 29

DESIGN	AH	**DART AEROSPACE LTD**	
DRAWN	RF	HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. E
MFG. APPR.		D412-664-243	SHEET 4 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE ASSEMBLY (412 HI AFT)	NTS
DATE	09.09.30		

COPYRIGHT © 2001 BY DART AEROSPACE LTD
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD

3.2 Crosstube Comparison

The Dart aft crosstube is defined by drawing D412-664-243. The Bell/AA aft crosstube dimensions are based on measurements taken from Aeronautical Accessories crosstube 412-321-304. The relative locations of the sections used in this comparison are shown in Figure 3 (on page 7). Table 1 gives the cross-sectional properties of the Bell/AA and Dart crosstubes at locations that correspond to changes in taper of the Dart crosstubes.

Table 1: Aft High-Gear Crosstube Cross-sections

SECTION	Cross tube	Damage Tolerance	O.D. (in)	I.D. (in)	Area (in^2)	Inertia (in^4)
A-A	Bell/AA Aft	0.000	3.500	2.250	5.645	6.108
	Bell/AA Aft w/ dam. tol.	0.000			5.645	6.077
	Dart Aft	0.000	3.500	2.250	5.645	6.108
	Dart Aft w/ dam. tol.	0.015			5.501	5.845
B-B	Bell/AA Aft	0.000	3.314	2.250	4.650	4.663
	Bell/AA Aft w/ dam. tol.	0.000	3.304		4.650	4.663
	Dart Aft	0.000	3.308	2.250	4.618	4.620
	Dart Aft w/ dam. tol.	0.015			4.417	4.410 4.381
C-C	Bell/AA Aft	0.000	3.169	2.250	3.911	3.693
	Bell/AA Aft w/ dam. tol.	0.015			3.881	3.617
	Dart Aft	0.000	3.163	2.250	3.881	3.655
	Dart Aft w/ dam. tol.	0.015			3.680	3.452
D-D	Bell/AA Aft	0.000	3.025	2.250	3.211	2.852
	Bell/AA Aft w/ dam. tol.	0.015			3.181	2.784
	Dart Aft	0.000	3.019	2.250	3.182	2.820
	Dart Aft w/ dam. tol.	0.015			2.981	2.657
E-E	Bell/AA Aft	0.000	2.890	2.250	2.584	2.166
	Bell/AA Aft w/ dam. tol.	0.012			2.560	2.116
	Dart Aft	0.000	2.884	2.250	2.556	2.138
	Dart Aft w/ dam. tol.	0.012			2.361	1.960
F-F	Bell/AA Aft	0.000	2.754	2.250	1.981	1.566
	Bell/AA Aft w/ dam. tol.	0.012			1.957	1.520
	Dart Aft	0.000	2.748	2.250	1.955	1.541
	Dart Aft w/ dam. tol.	0.012			1.759	1.368
G-G	Bell/AA Aft	0.000	2.690	2.250	1.707	1.312
	Bell/AA Aft w/ dam. tol.	0.012			1.683	1.269
	Dart Aft	0.000	2.684	2.250	1.682	1.289
	Dart Aft w/ dam. tol.	0.012			1.486	1.118
H-H	Bell/AA Aft	0.000	2.620	2.250	1.415	1.055
	Bell/AA Aft w/ dam. tol.	0.012			1.391	1.014
	Dart Aft	0.000	2.618	2.250	1.407	1.048
	Dart Aft w/ dam. tol.	0.012			1.212	0.879
J-J	Bell/AA Aft	0.000	3.000	2.250	3.093	2.718
	Bell/AA Aft w/ dam. tol.	0.038			3.017	2.547
	Dart Aft	0.000	2.990	2.250	3.045	2.665
	Dart Aft w/ dam. tol.	0.038			2.798	2.367

• COPYRIGHT © 2001 BY DART AEROSPACE LTD •
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.

4.2 Crosstube Strength Comparison (refer to Table 1 on page 9)

Table 4: Aft High-Gear Crosstube Strength Comparison

SECTION **	Cross tube	Bending Ultimate (lb*in)	Bending Yield (lb*in)	Tension Ultimate (lb)	Tension Yield (lb)	Shear Ultimate (lb)
A-A	Bell/AA aft w/ DT	229208	194480	372573	316123	237092
	Dart aft w/ DT	257186	220445	423592	363079	225549
	Margin of Safety	0.12	0.13	0.14	0.15	-0.05
B-B	Bell/AA aft w/ DT	185722	157582	306876	260379	195285
	Dart aft w/ DT	205296	175968	340111	291523	181098
	Margin of Safety	0.11	0.12	0.11	0.12	-0.07
C-C	Bell/AA aft w/ DT	150671	127842	256168	217355	163016
	Dart aft w/ DT	168076	144065	283367	242886	150884
	Margin of Safety	0.12	0.13	0.11	0.12	-0.07
D-D	Bell/AA aft w/ DT	121466	103062	209933	178125	133594
	Dart aft w/ DT	135559	116194	229531	196741	122218
	Margin of Safety	0.12	0.13	0.09	0.10	-0.09
E-E	Bell/AA aft w/ DT	96650	82006	168937	143340	107505
	Dart aft w/ DT	104653	89703	181799	155828	96802
	Margin of Safety	0.08	0.09	0.08	0.09	-0.10
F-F	Bell/AA aft w/ DT	72863	61823	129148	109580	82185
	Dart aft w/ DT	76653	65703	135478	116124	72138
	Margin of Safety	0.05	0.06	0.05	0.06	-0.12
G-G	Bell/AA aft w/ DT	62261	52827	111087	94256	70692
	Dart aft w/ DT	64153	54988	114454	98103	60943
	Margin of Safety	0.03	0.04	0.03	0.04	-0.14
H-H	Bell/AA fwd w/ DT	51075	43336	91820	77908	58431
	Dart fwd w/ DT	51690	44305	93291	79964	49675
	Margin of Safety	0.01	0.02	0.02	0.03	-0.15
J-J	Bell/AA fwd w/ DT	112069	95088	199089	168924	126693
	Dart fwd w/ DT	121931	104512	215450	184672	114720
	Margin of Safety	0.09	0.10	0.08	0.09	-0.09

203974
MS 0.09

*The negative shear margins are addressed in Section 4.4
**for Section A-A, the worst case corresponds to min stock OD instead of max stock OD, so the calculation is slightly different then the sample calculation presented in section 4.1

MS. FOR Ø3.304 TUBE AT SECTION B-B IS 0.09, STILL POSITIVE SO OK 11.03.10

• COPYRIGHT © 2001 BY DART AEROSPACE LTD •
THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.